



Annual Reports :: Year 6 :: The Astrobiological Exploration of Titan Focus Group

Focus Groups: The Astrobiological Exploration of Titan Focus Group

**Chair:**

***Jonathan Lunine***

## Project Progress

### ***Executive Summary***

Since the discovery of a methane atmosphere around Titan by Gerard Kuiper in 1944, Titan has been a world that has attracted much exobiological interest. Titan provides us with a planet-sized laboratory for testing the synthesis of organic compounds in a nearly neutral redox environment, over large spatial scales, both with and without liquid water. These natural chemical experiments could be ongoing today, and the products of such experiments in localized regions of elevated temperatures would be well preserved under the ambient 95 K temperatures and high atmospheric densities that shield the surface from destructive radiation.

The Cassini–Huygens mission arrived at Saturn June 30, 2004, and made a first set of distant observations of Titan (figure 1) before its planned inventory of the surface from a variety of remote sensing and in situ techniques, over the time period late 2004 through late 2008. The Huygens atmospheric probe will descend to the surface in January 2005. Before and after that the Orbiter will undertake some 45 close flybys of Titan. The result of the Cassini–Huygens mission will be a level of understanding of the geology, geodesy, atmospheric physics and surface–atmosphere interactions on Titan rivaling that for Mars after Mars Global Surveyor (MGS) (with the exception of a lack of a detailed global altimetric map of the body). Further, Cassini–Huygens will provide us with information regarding the distribution and nature of organics spread across the Titan surface. Should there be surface compositional variations in the organics, especially correlated with apparent geologic activity or crustal melting, the interest in returning to Titan to sample those interesting places directly, for signs of oxygen-bearing organics like amino or carboxylic acids for example, will be high.

Indeed, NASA has already expressed interest in initial planning for a post–Cassini mission to Titan, and it appears likely that such a mission will be high on the list of astrobiologically interesting programs in the planetary decadal strategy now being prepared. In March 2004 NASA selected two future Titan missions for study, one of which is led by the Titan Focus Group (TFG) Chair and is an organics analysis package for Titan's surface. A highlight of this effort will be a Jet Propulsion Laboratory (JPL) Team–X study of the mission, in

2005, in which the TFG will participate.

The Titan Focus Group is open to all interested parties, but all individuals who desire to participate are asked to identify themselves, their institution, and to commit to a certain amount of time and activity. Hence casual chat room browsers are discouraged. Most of the work of the group is by e-mail, but two or three meetings of the focus group are organized around convenient ancillary meetings (such as the NAI annual meeting).

### ***Focus Group Description & Activities***

The TFG met at NASA Ames this year after the AbSciCon 2004. A summary of the meeting is appended. It was decided to attempt the construction of a website for laboratory photochemical data to be used in analyzing Cassini data beginning late this year. Dr. Robert Minard of Penn State has agreed to begin this process

### Highlights

- Cassini reached Saturn orbit on June 30, 2004.
- NASA initiated two future Titan studies, one of which involves individuals from the Focus Group as PIs and collaborators.

### Roadmap Objectives

- **Objective No. 1.1:** Models of formation and evolution of habitable planets
- **Objective No. 2.2:** Outer Solar System exploration
- **Objective No. 3.1:** Sources of prebiotic materials and catalysts
- **Objective No. 3.2:** Origins and evolution of functional biomolecules
- **Objective No. 7.2:** Biosignatures to be sought in nearby planetary systems

### Mission Involvement

<b><i>Mission Class*</i></b>	<b><i>Mission Name (for class 1 or 2) OR Concept (for class 3)</i></b>	<b><i>Type of Involvement**</i></b>
1	Cassini–Huygens	Science Team Member
3	Titan Organics Explorer	Project Investigator

\* Mission Class: Select 1 of 3 Mission Class types below to classify your project:

1. Now flying OR Funded & in development (e.g., Mars Odyssey, MER 2003, Kepler)
2. Named mission under study / in development, but not yet funded (e.g., TPF, Mars Lander 2009)

3. Long-lead future mission / societal issues (e.g., far-future Mars or Europa, biomarkers, life definition)

**\*\* Type of Involvement = Role / Relationship with Mission**

Specify one (or more) of the following: PI, Co-I, Science Team member, planning support, data analysis, background research, instrument/payload development, research or analysis techniques, other (specify).

Cassini-Huygens will provide the data foundational to planning future missions to look for organic molecules on Titan's surface.

Titan Organics Explorer is a Visions mission proposal funded by NASA to study how to deliver advanced organics analysis packages to the surface of Titan